MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

2N6029 thru 2N6031
See Page 3-105

PNP	NPN
2N6034	2N6037
2N6035	2N6038
2N6036	2N6039

PLASTIC DARLINGTON COMPLEMENTARY SILICON POWER TRANSISTORS

. . . designed for general-purpose amplifier and low-speed switching applications.

- High DC Current Gain — h_{FE} = 2000 (Typ) @ I_C = 2.0 Adc
- Collector-Emitter Sustaining Voltage — @ 100 mAdc
  $V_{CEO(sus)}$ = 40 Vdc (Min) — 2N6034, 2N6037
  = 60 Vdc (Min) — 2N6035, 2N6038
  = 80 Vdc (Min) — 2N6036, 2N6039
- Forward Biased Second Breakdown Current Capability $I_{S/b}$ = 1.5 Adc @ 25 Vdc
- Monolithic Construction with Built-In Base-Emitter Resistors to Limit Leakage Multiplication
- Space-Saving High Performance-to-Cost Ratio TO-225AA Plastic Package

DARLINGTON 4-AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS

40, 60, 80 VOLTS
40 WATTS

***MAXIMUM RATINGS**

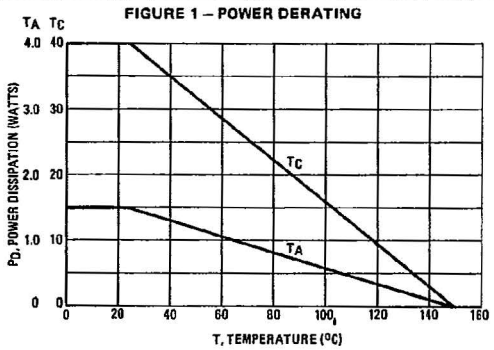
Rating	Symbol	2N6034 2N6037	2N6035 2N6038	2N6036 2N6039	Unit
Collector-Emitter Voltage	V_{CEO}	40	60	80	Vdc
Collector-Base Voltage	V_{CB}	40	60	80	Vdc
Emitter-Base Voltage	V_{EB}	5.0			Vdc
Collector Current — Continuous	I_C	4.0			Adc
Peak		8.0			
Base Current	I_B	100			mAdc
Total Power Dissipation @ T_C = 25°C	P_D	40			Watts
Derate above 25°C		0.32			W/°C
Total Power Dissipation @ T_A = 25°C	P_D	1.5			Watts
Derate above 25°C		0.012			W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150			°C

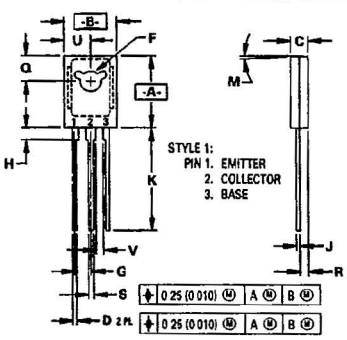
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	3.12	°C/W
Thermal Resistance, Junction to Ambient	θ_{JA}	83.3	°C/W

*Indicates JEDEC Registered Data.

FIGURE 1 – POWER DERATING





NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	10.80	11.04	0.425	0.435
B	7.50	7.74	0.295	0.305
C	2.42	2.66	0.095	0.105
D	0.51	0.66	0.020	0.026
F	2.93	3.17	0.115	0.125
G	2.39 BSC		0.094 BSC	
H	1.27	2.41	0.050	0.095
J	0.39	0.63	0.015	0.025
K	14.61	16.63	0.575	0.655
M	3° TYP		3° TYP	
Q	3.76	4.01	0.148	0.158
R	1.15	1.39	0.045	0.055
S	0.64	0.88	0.025	0.035
U	3.69	3.93	0.145	0.155
V	1.02	—	0.040	—

CASE 77-06
TO-225AA TYPE

3

2N6034, 2N6035 , 2N6036 PNP
2N6037, 2N6038, 2N6039 NPN

***ELECTRICAL CHARACTERISTICS** (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Sustaining Voltage (I_C = 100 mAdc, I_B = 0)	2N6034, 2N6037	$V_{CEO(sus)}$	40	–	Vdc
	2N6035, 2N6038		60	–	
	2N6036, 2N6039		80	–	
Collector-Cutoff Current		I_{CEO}			μA
(V_{CE} = 40 Vdc, I_B = 0)	2N6034, 2N6037		–	100	
(V_{CE} = 60 Vdc, I_B = 0)	2N6035, 2N6038		–	100	
(V_{CE} = 80 Vdc, I_B = 0)	2N6036, 2N6039		–	100	
Collector Cutoff Current		I_{CEX}			μA
(V_{CE} = 40 Vdc, $V_{BE(off)}$ = 1.5 Vdc)	2N6034, 2N6037		–	100	
(V_{CE} = 60 Vdc, $V_{BE(off)}$ = 1.5 Vdc)	2N6035, 2N6038		–	100	
(V_{CE} = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc)	2N6036, 2N6039		–	100	
(V_{CE} = 40 Vdc, $V_{BE(off)}$ = 1.5 Vdc T_C = 125°C)	2N6034, 2N6037		–	500	
(V_{CE} = 60 Vdc, $V_{BE(off)}$ = 1.5 Vdc T_C = 125°C)	2N6035, 2N6038		–	500	
(V_{CE} = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc T_C = 125°C)	2N6036, 2N6039		–	500	
Collector Cutoff Current		I_{CBO}			mAdc
(V_{CB} = 40 Vdc, I_E = 0)	2N6034, 2N6037		–	0.5	
(V_{CB} = 60 Vdc, I_E = 0)	2N6035, 2N6038		–	0.5	
(V_{CB} = 80 Vdc, I_E = 0)	2N6036, 2N6039		–	0.5	
Emitter Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)		I_{EBO}	–	2.0	mAdc
ON CHARACTERISTICS					
DC Current Gain		h_{FE}			–
(I_C = 0.5 Adc, V_{CE} = 3.0 Vdc)			500	–	
(I_C = 2.0 Adc, V_{CE} = 3.0 Vdc)			750	15,000	
(I_C = 4.0 Adc, V_{CE} = 3.0 Vdc)			100	–	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 2.0 Adc, I_B = 8.0 mAdc)			–	2.0	
(I_C = 4.0 Adc, I_B = 40 mAdc)			–	3.0	
Base-Emitter Saturation Voltage (I_C = 4.0 Adc, I_B = 40 mAdc)		$V_{BE(sat)}$	–	4.0	Vdc
Base-Emitter On Voltage (I_C = 2.0 Adc, V_{CE} = 3.0 Vdc)		$V_{BE(on)}$	–	2.8	Vdc
DYNAMIC CHARACTERISTICS					
Small-Signal Current-Gain (I_C = 0.75 Adc, V_{CE} = 10 Vdc, f = 1.0 MHz)		$\|h_{fe}\|$	25	–	–
Output Capacitance		C_{ob}			pF
(V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz)	2N6034, 2N6035, 2N6036		–	200	
	2N6037, 2N6038, 2N6039		–	100	

*Indicates JEDEC Registered Data.

FIGURE 2 – SWITCHING TIMES TEST CIRCUIT

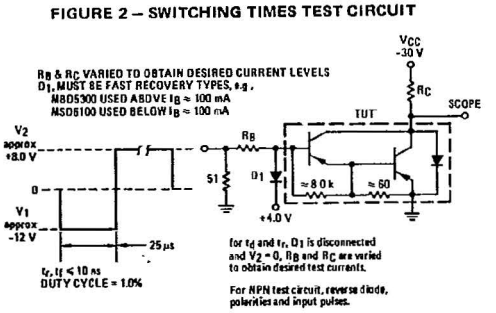


FIGURE 3 – SWITCHING TIMES

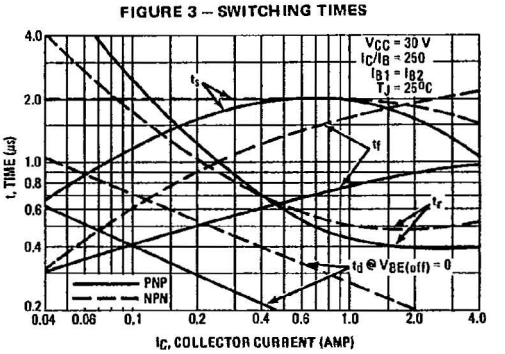
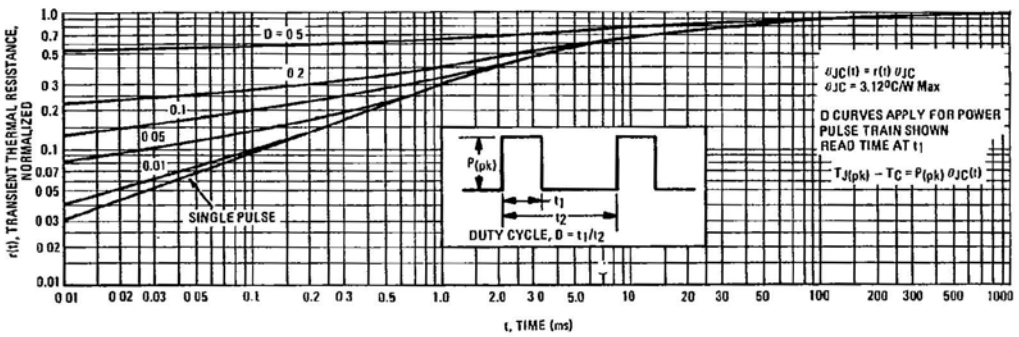


FIGURE 4 -- THERMAL RESPONSE



ACTIVE-REGION SAFE-OPERATING AREA

FIGURE 5 -- 2N6034, 2N6035, 2N6036

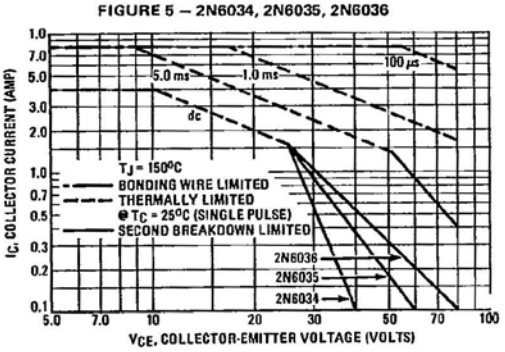
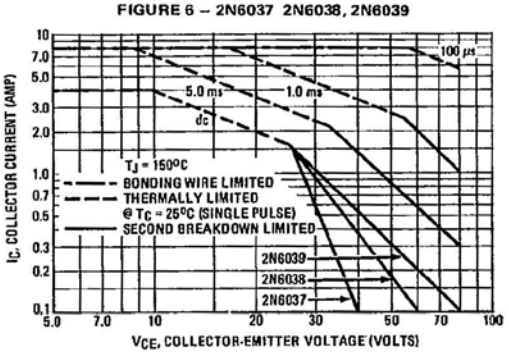


FIGURE 6 -- 2N6037 2N6038, 2N6039

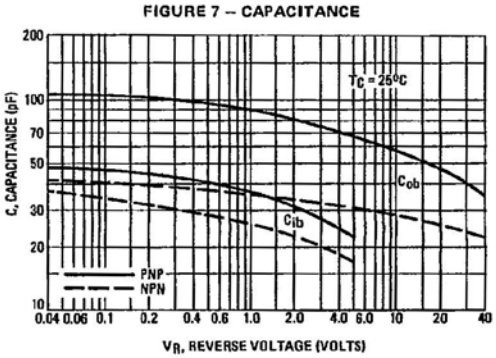


3

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figures 5 and 6 is based on $T_{J(pk)} = 150^{\circ}C$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} < 150^{\circ}C$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

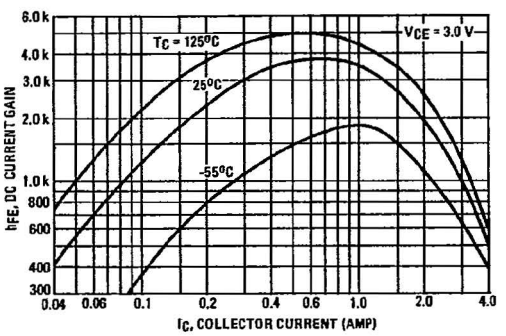
FIGURE 7 -- CAPACITANCE



PNP
2N6034, 2N6035, 2N6036

NPN
2N6037, 2N6038, 2N6039

FIGURE 8 – DC CURRENT GAIN



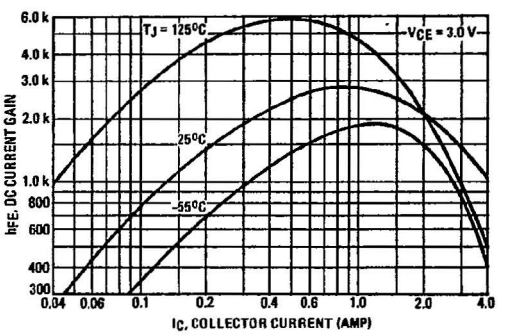
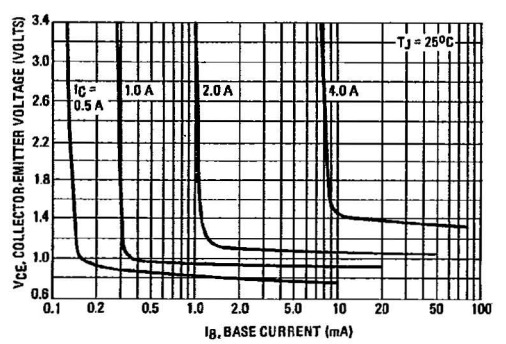


FIGURE 9 – COLLECTOR SATURATION REGION



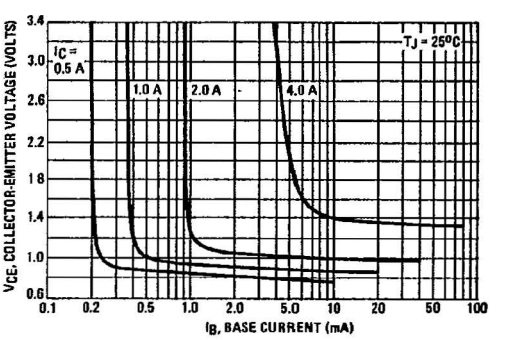
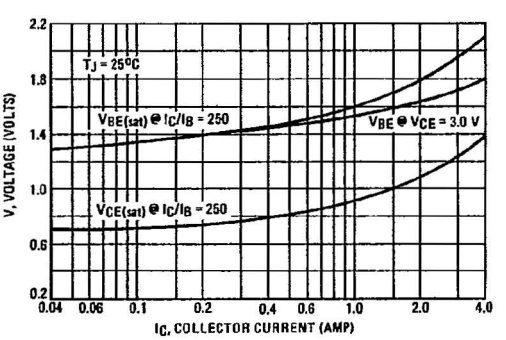
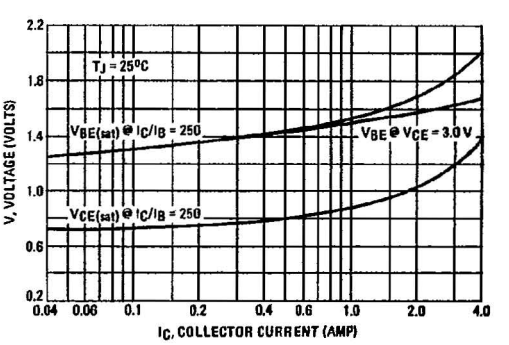


FIGURE 10 – "ON" VOLTAGES





3